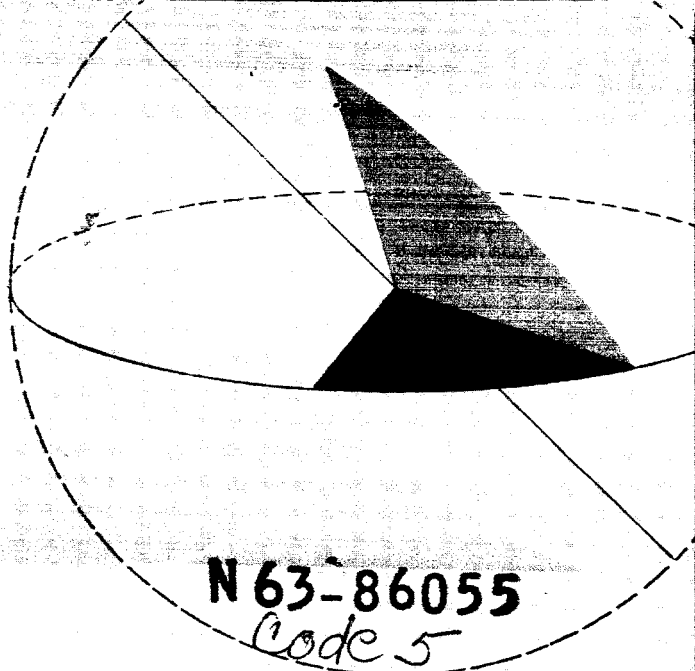


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TRANSLATION NO. 21

**FIFTH SOVIET
SPACESHIP-SATELLITE**



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MAY 1, 1961

National Aeronautics and Space Administration

(NASA Contract NASw-6)

ASTRONAUTICS INFORMATION

Translation No. 21

FIFTH SOVIET SPACESHIP-SATELLITE,

Soviet News Coverage,
March 26-28, 1961

Compiled and translated by
Joseph L. Zygielbaum

May 1, 1961 26 p

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JET PROPULSION LABORATORY
California Institute of Technology
Pasadena, California

May 1, 1961

PRAVDA, March 26, 1961

TASS Communiqué

In accordance with the plans for the investigation of cosmic space, the Soviet Union placed its fifth spaceship-satellite in orbit around the Earth on March 25, 1961.

The principal purpose of this launching was further testing of the construction of the spaceship-satellite and its component systems which are designed for assuring life activity of a man during his forthcoming flight into space and return to Earth.

The spaceship-satellite's orbit is very close to that calculated: its rotational period is 88.42 min, perigee is 178.1 km, apogee is 247 km from the surface of the Earth, and the orbital inclination towards the equatorial plane is $64^{\circ}54'$.

The weight of the spaceship-satellite is 4695 kg, not including the last stage of the carrier rocket.

A cabin installed aboard the spaceship-satellite contains animals, the dog "Zvezdochka" and other biological objects, as well as telemetry and television systems, a radio system for trajectory measurements, and radio-communication instruments.

The instruments aboard the spaceship operated in a normal manner during the flight.

After the completion of the assigned program of investigations, the spaceship-satellite received a command from Earth the same day and landed successfully at a predesignated area in the Soviet Union.

A preliminary examination of the returned spaceship-satellite indicated that the experimental animals showed no ill effects as a result of their flight and that they behaved in a normal manner.

As a result of the launching of the fifth Soviet spaceship-satellite and its successful return to Earth, a great amount of valuable data was obtained about the

operation of the spaceship's structure and its systems, as well as on the influence conditions of flight had on live organisms.

A study and a processing of these data are now in progress.

The biological objects which completed the flight into space are under constant observation.

MAN AND SPACE

by

Academician N. Sisakyan

The fifth Soviet spaceship-satellite, weighting 4695 kg, was launched from the territory of the Soviet Union on March 25, 1961, carrying aboard in its cabin the dog Zvezdochka and other biological objects. That same day, by a command from Earth, the spaceship left its orbit and returned to a predetermined point in the territory of the Soviet Union.

The entire world is fascinated by the flight of the Soviet spaceship-satellites, and great interest is shown in the outstanding results which were obtained by our scientists during these investigations of the universe. This great interest of Soviet and foreign scientific societies is justified, first of all, by the fact that each such flight enriches science with new important facts about the effect of conditions of cosmic space on live beings, and it yields valuable information on the operation of complex investigation instruments, automatic devices and spaceship equipment. New information is being accumulated on the unknown depths of space. Finally, we are getting a clear picture of the increasing power of our rocket systems which deliver, with unchangeable accuracy, always heavier and heavier spaceships into cosmic space.

The successful flights of various live beings and their safe return to Earth in recent months have also another very important fundamental value. With each such flight we come closer to the moment when the passenger of a cosmic ship will be a man. This will be a new historic milestone in the development of science.

Problems of Great Importance Have Been Solved

The successful launchings of spaceships have demonstrated to the entire World the wide possibilities of Soviet science and technology. An abundance of experimental material which testifies to the complete possibility of cosmic flights of a man, at the present time, has been obtained. However, the humanitarianism of Soviet science, the feeling of great responsibility for the fate of each man, make it necessary to conduct a series of experimental launchings of spaceship-satellites in order to be completely certain about the safety of flight and successful return to Earth of the first astronauts.

When evaluating the possibilities of cosmic flights of a man, it is necessary to consider two sides of the problem, the technical and biological.

From the viewpoint of technical possibilities, a manned flight into space can be accomplished today, and, more accurately, such a flight could have been accomplished even several months ago. The weight of the second spaceship-satellite, which has carried out its flight and returned safely to Earth with its load of numerous live organisms, was 4.6 tons. One should assume that in such a huge spaceship it would have been possible, without any special difficulties, to orbit a man, whose weight would have been less than 2% of the entire weight of the spaceship. Consequently, from a technical viewpoint, a cosmic flight of a man could have been accomplished in August of last year, during the launching of the second spaceship-satellite.

However, it is necessary for the purpose of such an experiment to solve a number of extraordinarily complicated biological problems. Preparation and carrying

out of flights of various live organisms aboard spaceships and artificial Earth satellites began with the flight of the pioneer of cosmic travel, the dog Laika, and represent a continuous series of biological investigations which are designed to solve such problems.

Numerous vertical launchings of rockets, carrying animals, which were conducted in our country have made it possible to accumulate broad experimental material on the behavior of live organisms under conditions similar to cosmic flights. The animals were subjected to a number of tests and were then safely returned to Earth. However, vertical altitude flights as well as flights along ballistic trajectories are not actually cosmic flights. During such flights many factors are not present which are characteristic only of cosmic flights. The study of such factors, and their effect on live organisms, is possible only during flights aboard artificial Earth satellites and spaceships.

For this reason, it was necessary first of all to develop methods and means for securing normal-life conditions for the passengers of cosmic ships (maintaining a definite composition of the atmosphere of the spaceship, its pressure, temperature, assurance of feeding procedures of the animals, and the creation of sanitary conditions). A series of excellent biological experiments aboard spaceship-satellites and altitude rockets followed. These experiments have considerably enriched our knowledge about the effect on live organisms of flight conditions aboard rocket-propelled instruments and have made it possible to take another important step on the road toward the preparation of a manned flight into space. A broad general biological approach toward the solution of the assigned scientific problems, the application of biotelemetry and a number of other new methods for investigations, and the utilization

of a variety of biological objects made it possible to obtain broad and extremely valuable scientific material and reach new and interesting conclusions.

The experiments aboard spaceships were designed with a consideration of the largest scope of various biochemical systems and live matter. For this purpose ferments, frogs, viruses, preparations of cell nuclei, cytoplasmic cells, bacteria cultures, human and rabbit tissues, fungi, etc., were utilized. Then there was a selection of a variety of plant life, dogs, mice, rats, guinea pigs and certain other organisms. The program included a large number of biochemical, microbiological, immunological, psychological, genetic, and physiological investigations. (See Fig. 1.)

Thanks to the application of radio telemetry and television methods, complete and valuable information was obtained on any changes which took place in the basic physiological functions of organisms and on the behavior of the experimental animals during various portions of flight.

As is known, dogs and other biological objects which were sent on cosmic flights are quite undisturbed by external conditions and can endure, without any ill effects to their physiological functions, considerable variations of temperature, humidity, and air pressure, as well as changes in the contents of oxygen. Nevertheless, during the preparation of cosmic flights, special efforts were made to decrease to a minimum the allowable variations of these magnitudes, having in mind the creation of the most favorable conditions for the existence of live organisms inside the cabin of a spaceship. Essential deviations of these magnitudes from normal limits would have placed animals under conditions of additional physiological stress and would have increased the difficulties of their cosmic flights.

Soviet scientists were successful in assuring the necessary environment in the inhabited part of the cosmic ship and also in obtaining information on changes of these conditions during the flight period. In that manner, during the duration of the flight of the second spaceship-satellite, a normal air pressure with an oxygen content of from 21 to 24%, humidity from 37 to 40%, and temperatures from +17 to +20°C, were maintained in the cabin.

Of course, such a narrow range of variations of basic parameters is not necessary for animals. However, having in mind the further development of cosmic flights from the beginning of these experiments, attempts were made to create conditions which are most favorable for the organisms of a man.

From the very first moment of flight aboard a spaceship, the animal is subjected to the influence of a number of factors, the majority of which cannot as yet be duplicated during ground and laboratory experiments and the investigation of which is possible only under actual flight conditions.

During the injection of the spaceship into orbit, the basic effecting factors are: accelerations connected with a sharp increase of flight velocity during this period, vibration, and noise.

After the ship enters its orbit, acceleration is replaced by a state of weightlessness. This state lasts during the entire period of orbital flight and is replaced by a braking acceleration during the spaceship's re-entry into the dense layers of the atmosphere.

Finally, during the entire duration of the orbital flight, the animals are subjected to the effects of cosmic radiation, the biological influence of which requires thorough and systematic investigations.

The study of this entire complex of problems which composes the basis of contents of that new branch of science, space biology, began with the flight of the second Soviet artificial Earth satellite which carried the dog, Laika. Laika's flight has shown that the basic danger, which was connected with a possibility of extended presence of highly developed animals in a state of weightlessness, was eliminated.

A Fundamental Contribution to Science

Since then our scientists have made possible the use of heavy spaceships for an all-sided complex investigation of the effects of factors of cosmic flights on live organisms.

A considerable part of this program was accomplished during the flight of the second spaceship-satellite, which carried aboard two dogs, Belka and Strelka, and also many other biological objects. During this flight, we succeeded in bringing back from orbit live animals after they spent an entire day aboard an orbiting artificial Earth satellite.

Radiotelemetry and television information from aboard the spaceship was transmitted to Earth during the duration of the flight. These data testify to the fact that the animals endured the periods of vibration and acceleration effects very well during the active sector of flight and transition into a state of weightlessness. One and one-half hours after launching the artificial Earth satellite, principal readings of the physiological condition of the animals (frequency of heart beat, breathing, blood pressure) proved to be close to the original (before flight). This testifies to the sufficiently fast adaptability of animals toward the flight in a state of weightlessness.

Further observations on the state of the animals did not reveal any deviations from the physiological norms.

Telemetry measurements and data from observations of the animals immediately landing have shown that the difficulties connected with the re-entry of the spaceship into the dense layers of the atmosphere and landing of the container with the animals were also overcome successfully. This testifies to the fact that the means which were developed by our science and technology for securing the maintenance of necessary conditions for life activities of organisms during an extended flight and a successful return to Earth, and all associated problems, were successfully solved.

The scientific value of this experiment is not limited to the objective information which was obtained from the spaceship. A broad program of biological experiments during this flight, as well as during the flights of the fourth and fifth spaceship-satellites, made it possible to obtain a considerable amount of data about the future effects of cosmic flight on live beings. This part of the experiment is of tremendous value in the preparation for a manned flight into space. In the present stage of investigations in the field of space biology, even a small fact might be of important scientific value.

On November 30, 1960, in the life of the now-known four-legged astronaut, Strelka, an important event took place. She gave birth to 6 pups which are now healthy little dogs, growing in a normal manner. Strelka coped very successfully with the bringing up of her little pups, showing thereby the characteristic motherly behavior and reflexes which are normal during this period in the life of a dog. (See Fig. 2.)

As far as science is concerned, this situation is of extreme importance, since it is direct proof that the influence of many very complicated factors of cosmic flight on the organism of an animal do not disclose any unpleasant after-effects, particularly in regard to that function which, as is known, is the most sensitive and can be damaged as a result of cosmic radiation. It is understood that this conclusion pertains only to the concrete extent of the entire flight and to the determined orbit. Nevertheless, even taking into account these conditions, this fact is a fundamental contribution toward the still-young science of space biology.

Facts and Conclusions

We cannot, at the present time, consider as conclusive all observations of biological objects after their cosmic flights. However, the data which are already available indicate that the influence of flight factors might vary in direction and biological value.

Of greatest value are the numerous and various data which testify, in their entirety, to the fact that the flight conditions aboard spaceships along a circular orbit, which is located below the near-Earth radiation belts, do not necessarily have ill effects on the life activity of organisms and do not cause any permanent and noticeable distortions in their basic physiological functions.

It is of interest that dry seeds of certain plants (for instance, onions) which were planted after they were recovered from the second spaceship-satellite, have germinated and grown at a much faster rate than usual. The processes of self-division and growth in these germinating seeds were considerably faster in comparison with controlled seeds. The most accelerated process of growth was observed

in certain ray-fungi, which are of great interest to us because they produce the widely-known medical substance, antibiotics. Observations of this type obviously are within the framework of the concept of radio stimulation, which was developed in laboratory experiments particularly during the past few years.

However, during the investigation of the rate of growth of the culture of radio-sensitive stock of a ray-fungus (8594), its germinating power (by the number of its developed spores and colonies decreased by 12 times the rate of controlled seeds.

A psychological analysis of material which was obtained from germinations of certain plants (pea and wheat) has disclosed a noticeable increase in the frequency of chromosomal rearrangements in the cell's rootlets and growing points. Analogous, but less obvious, changes were noticed in the separating cells in bone marrow of mice.

Thus, as a result of the conducted investigation the presence was discovered of varying (by direction and biological value) effects of cosmic flight sectors on the life capability and hereditary properties of various animals and foreign objects.

In the preparation for extended flight, the investigations of the dynamics of natural immunity in animals during cosmic flight are of interest. Preliminary data which are now available testify to the purpose of changes in the condition of the immunological activity of blood in dogs after flight, particularly under increase of its phagocytic function; that is, its capability to fight infection.

The flight of the fourth Soviet spaceship-satellite was of great value in solving the problem for cosmic investigation. The function of the biological part of this experiment was further investigation of the effects of conditions of cosmic flight on the state of live organisms in order to determine the affectivity and reliability of operation of the system for life safety. Data which we have in our possession now testify

to the fact that these systems are reliable and provide the desired conditions for all flight sectors.

The many biological objects (the dog, mice, guinea pigs, insects, etc.) which have participated in this flight will permit our scientists to tackle a considerable number of problems of extreme importance and great scientific and practical value.

The experimental material of this flight is still being processed and analyzed. The obtained data will supplement and broaden considerably our knowledge on the influence of factors of cosmic flight on the life of an organism.

All these data are of considerable interest because they were obtained under conditions of natural cosmic radiation in which the contents and energy of particles differ considerably from the contents and energy of particles of the radiation used by scientists in normal laboratory investigations.

It should be said that the data obtained on the remote after-effects of cosmic flights cannot be, at the present time, ascribed accurately as to the effect of any specific factor. Obviously these after-effects should be ascribed to an entire complex of influences of cosmic flight.

Obviously, during future investigations, we should consider the necessity for differentiated study of biological values of each of the factors of cosmic flight, acceleration, vibration, and weightlessness. This work is in progress at present.

Realistic Perspectives

The experiments which were conducted with the help of the spaceship-satellite have made it possible to do the following:

To determine and prove the effectiveness of a number of systems which assure conditions for active life aboard the spaceship;

To investigate the influence of flight sectors on a complex of physiological and biological indicators;

To appropiate methods of investigation and to select biological objects which are most suitable for solving corresponding theoretical and practical problems.

It is characteristic, in the case of rapidly developing branches of science, that the achieved results, no matter how considerable, often prove to be insufficient in the perspective of new scientific investigations beginning to unfold.

Assuring safety of manned spaceflight for a short period of time is considerably simpler than it is for longer periods of time. Extended cosmic flights of a man, and particularly the accomplishment of interplanetary flights, present considerably more complicated problems to the science of biology than the problems discussed above. For instance, the securing of the necessary gas environment inside the hermetically sealed cabin of a space ship during a short flight can be accomplished with the help of highly active chemical matter, which discharges oxygen during the absorption of water vapors and carbon dioxide which is exhaled by animals. In the case of extended flight or interplanetary travels, the creation of a complete ecological environment within a sealed space is required. As is known, the basic requirements for the creation of such a medium was outlined by K. E. Tsiolkovsky. First of all, it is necessary in this case to create conditions similar to those man has on Earth: regeneration of air, during which biological methods will play an important role, and the clarification of methods for the utilization of human discharges; that is, the

development of all conditions which would secure the comfort of Earth life aboard a spaceship, by utilizing these possibilities which cosmic space makes available.

Therefore, the preparation toward long cosmic flights requires the development of new approaches, principles, and means in order to secure a normal life activity, work, and respiration of the crew of a spaceship. The correct way toward this goal was dictated to us by the nature of our own planet.

In all probability, the unavoidable companions of a man in a future cosmic flight, including also flights to other planets, will be green plants. On the Earth, these plants form conditions which are necessary for the life of animals and man. They create organic matter which serves as food to animals and man, they purify the air by removing carbon dioxide gas which is a product of the breathing of animals and man, and, they discharge vitally necessary oxygen during the process of photosynthesis. This work is carried out by land plants and, to even a much greater extent, by small algae which are much more numerous and which multiply very rapidly.

The necessity to supply future astronauts with whole value food rations probably requires the incorporation into their system of life preservation animals which would utilize the plants as a food and would convert them into more whole value vital products which are necessary for man's own feeding. One can imagine that, at a certain point, it will become expedient to utilize the products of the animals vital functions with the help of bacteria and the above-mentioned algae, exactly as it takes place in natural surroundings.

Thus, the means for assuring the basic life conditions for the crew of a future interplanetary spaceship might be presented as a closed system of a biological cycle

of matter, where there is no necessity for piling up large food supplies, but where everything that is necessary for a man is provided by green plants, and the utilization of the energy of solar rays, carbon dioxide and water from the atmosphere of the cabin of the spaceship, etc.

In this connection, great problems arise for our physiologists, microbiologists, biochemists, biophysicists, and geneticists. It is difficult to find an area of biology whose contribution would not have important meaning in the development of the complex of problems which now comprise the subject of space biology. An important place in these investigations is occupied by the study of the unicellular microscopic green algae, which is a unique oxygen factory and which will quite obviously be a valuable companion for astronauts during long-lasting travels.

A manned space flight will open other large possibilities to science. Over a period of many years, scientists were, and still are, discussing the problem of life in space. On the basis of indirect data various hypotheses were presented, the verification of which required direct proof. It is difficult, therefore, to express a final judgement on the possibility and forms of life on other planets. Now, the study of these problems is being conducted by means of experiments. Thus, biological science has obtained a realistic possibility for the study of the problems of life in cosmic space.

By its importance and possible result, this problem takes on a fundamental value. The assignment in itself, as well as the approach toward a solution of the problems of life in space, became possible as a result of the achievements of chemistry, physics, mathematics, reactive technique, radio technique and electronics. In its turn, the explanation of the laws of life, involving the nature of vital processes, are

enriching this science and bringing up new, unusual problems. In this process is contained one of the characteristics of co-activity of sciences in contemporary natural science.

Indeed, the possibilities will be unlimited to the man who will accomplish the exit into the limitless realms of cosmic space. Invaluable also is the role of cosmic biology in presenting such a possibility to man. There is no doubt that Soviet scientists will not spare any efforts for the realization of this grandiose assignment.

PRAVDA, March 28, 1961

The dog Zvezdochka which accomplished the flight aboard the fifth spaceship-satellite and was successfully returned to Earth on March 25, 1961, was delivered to Moscow.

The correspondent of TASS has learned at the Academy of Sciences, USSR, that, in addition to Zvezdochka, the hermetically sealed cabin of the spaceship-satellite also contained laboratory mice, guinea pigs, frogs, microbes and viruses, ray-fungi, dry seeds of various plants, sprouts of onion and certain other organisms, as well as a solution of deoxyribonucleic acid and various ferments.

The dog Zvezdochka is a female of white coloring with dark spots. She weighs about 6 kg.

Thanks to the normal conditions which were created aboard the spaceship-satellite, and to the faultless operation of the technical means which have secured the return of the spaceship to the predetermined region of the Soviet Union, all "travelers" (that is, the animals and plant organisms as well as the scientific instruments) were

turned over to the laboratory for a follow-thorough observation and study without any visible bad after-effects.

The results of preliminary observations showed that the biological objects are in a satisfactory state and have completely preserved their vital activity. The characteristics of basic physiological properties of the dog Zvezdochka do not differ practically from the data which were registered before the flight.

The scientific instrumentation aboard the fifth Soviet spaceship-satellite functioned in a normal manner. The obtained radiotelemetry information is being processed.

The principal purpose of the experiment aboard the fifth spaceship-satellite, as well as the series of preceding spaceship-satellites, was to obtain information necessary for the purpose of assuring a manned flight into space and a safe return to Earth.

The scientific assignment included the following:

To determine the properties of operation and effectiveness of the systems for life preservation and return to Earth which were installed aboard the spaceship;

The study of effects of conditions of cosmic flight on a variety of live organisms;

The study of remote biological after-effects.

BIOLOGY AND SPACE

by V. Parin

Active Member of Academy of Medical Sciences, USSR

per IZVESTIA, March 28, 1961

We are now at the threshold of one of the most significant events in the history of human culture, a flight of a man into space. We left behind us a difficult and long road which required a lot of research.

It was essentially necessary to create a new science, space biology and medicine. Only a short few years ago we were standing on the threshold of the unknown. We could only presume how the organisms of animals and plants would withstand complicated conditions of cosmic flight. However, an assumption is not a science--at best, it can be described as a stimulant to the creation of a science.

Now, we are no longer assuming, we already know quite a bit. This knowledge and available data are the first results of the birth, establishment, and development of cosmic biology and medicine. Born during the period of contiguity of many scientific and technical disciplines such as physiology, biology, biophysics, biochemistry, aviation medicine, aerodynamics and rocket technique, geophysics and astronomy, radio electronics, etc., cosmic biology and medicine grew by utilizing the achievements of these sciences and developed with them.

Let us take a look at that new science which is young in time but experienced by great efforts and glorious results; let us see if everything possible was done in order to make an astronaut feel secure, beginning with the first flight.

What will a man encounter during flight into space? Let's start from the beginning. First of all, he will experience considerable acceleration during the

period when the spaceship develops the necessary speed. In the case of an orbital flight around the Earth, the astronaut will be subjected to a state of weightlessness after the spaceship's injection into orbit.

During his flight, depending on altitude, a man will encounter actual cosmic radiation of various intensity. These radiations possess a great penetrating capability and are, generally speaking, dangerous. During his descent to Earth, the astronaut will experience accelerations which are caused by the braking of the spaceship. In addition, during the entry into the dense layers of the Earth's atmosphere, the walls of the spaceship will heat up. This, of course, presents a definite danger for a man, if proper technical steps are not taken. Naturally, during the entire period of flight, the astronaut should be in a hermetically sealed cabin which will reliably isolate him from the surrounding space and secure the necessary conditions for gas exchange and temperature.

All these are highly complicated problems. They had to be solved step by step. In the beginning, scientists received a variety of information on the physical properties of cosmic space, particularly on the contents and intensity of cosmic radiation, with the help of special physical instruments which were placed in the nose cones of rockets or aboard satellites. With the help of instruments, the magnitudes of acceleration at various stages of travel and the intensity of vibration of the rocket were also explained. When this preliminary stage was completed, the investigations with animals began.

The first experiments with vertical rocket firings of animals began in the Soviet Union as early as 1949. In the beginning, scientists conducted a series of experiments with launchings of experimental animals to altitudes of 100 km; then the

altitude was increased to 200 km. The last stage of such investigations with vertical launchings was completed several years ago. The maximum altitude of such flights was then more than 400 km.

During these experiments, it was explained how animals endure acceleration, and a series of systems was developed for securing a normal active life of the animals.

First of all, in order to isolate the animals from the decreased pressure of the surrounding space, it was necessary to construct hermetically sealed cabins equipped with instruments for the regeneration of air, for an automatic supplement of oxygen, and for the absorption of carbon dioxide which is exhaled by the animals.

After this, a system for ejection of the animals from the rocket at a determined altitude above the Earth and a system for automatic parachutes which are necessary in order to bring the animals safely back to Earth, were developed.

Before animals could be sent into cosmic space it was necessary to overcome one more obstacle.

Under these conditions, in order to obtain the necessary information on the state of the animals during the flight, it was necessary to construct beforehand a number of instruments for the radio transmission of data on the physiological state of the animals. The basic principle of such instruments is that, with the help of special converters or transmitting elements, physiological data which are of interest to scientists is being converted into variations of electric current. The electrical impulses, in turn, should modulate radio waves which are propagated by the radio transmitter aboard the satellite. At ground stations, these radio signals are received by special

recording radio receivers and installations. All this radiotelemetry instrumentation should operate accurately and reliably.

The first experiment was conducted with the dog Laika. We succeeded then for the first time in obtaining data on the behavior of animals in conditions of extended weightlessness--weightlessness which lasted for many hours. It was proven that the animal quickly adapted itself to the entirely unusual conditions of weightlessness and that the functions of its organism, such as, blood circulation and breathing, did not actually deviate from a normal state.

Laika's flight has therefore proven that animals are capable of withstanding extended conditions of weightlessness without any ill effects.

After that, Soviet constructors of cosmic ships achieved a new, brilliant victory by developing an excellent system which assured the possibility of a space-ship's return to Earth and its safe descent and landing at a preselected area. These technical means have made it possible to proceed toward a new, even more interesting, stage of biological investigations. The value of these new experiments has increased immensely since scientists now have a means of extended observation of animals in laboratory conditions after their return from a cosmic trip, and consequently can study all possible immediate and distant biological after-effects of cosmic flights.

This is particularly important for the evaluation of the effect of cosmic radiation.

As is well known, the energy of rays, including cosmic rays, possess unusual properties. The effect of rays do not appear immediately but after some time has passed, depending on the intensity of radiation to which the organism was subjected.

The greater the intensity, the shorter is the period after which the effects of this radiation will appear. Therefore, before we can even talk about a cosmic flight by a man, it is important to determine how animals will withstand radiation, and if there will be any harmful after-effects sometime later from the influence of cosmic radiation.

Data which were obtained on the physics of the space which surrounds the Earth testify to the fact that our planet is surrounded by two belts of powerful radiation. However, at the altitude over which the second cosmic ship traveled, the radiation level was comparatively small and there was obviously no concern about any harmful after-effects for the animals. It is understood, however, that, in view of the responsibility of such a conclusion, it was necessary to double check this conclusion experimentally. For the purpose of double checking these assumptions, the flight of the second cosmic ship with Belka and Strelka aboard was conducted. More than one-half a year has passed since then. During this period of time, we were able to establish that the dogs did not suffer any after-effects from the dose of radiation which they received during that flight.

Laboratory mice and flies participated with the dogs in this trip. Flies are quite sensitive to the effects of ray energy. Of equal importance is the fact that a great number of flies could participate in that flight, which made it possible to check if the obtained results are accidental or if they are binding as a rule. In the case of mice, bone marrow, which is the most sensitive to the effects of ray energy, was investigated, and it was established that there were no ill effects of radiation on the activity of the blood creating systems. The blood composition in the case of mice also remained normal. Investigations of a genetic character were conducted with flies.

In addition to dogs, cosmic ships also carried guinea pigs, black laboratory mice, plant seeds, and sprouts. Of great interest is the fact that cosmic rays proved to have a positive effect on germinated seeds in the sense that these seeds germinated much faster. The resulting plants are developing very well.

The next cosmic ship which carried the two dogs Pchelka and Mushka, as well as the following launchings of cosmic ships-satellites with Chernushka and Zvezdochka did not attempt to achieve new goals. The reason for these flights was to study further the cosmic route and the conditions of flight.

We will underline certain basic results of these experiments. It was proven, first of all, that acceleration which occurs during the active sector of flight (during the injection of the cosmic ship into orbit), can be withstood without any harmful after-effects. It was experimentally established that comparatively long-lasting states of weightlessness can be endured. The reliability of operation of systems which assure the re-entry of the spaceship from orbit with animals and its landing were checked. Difficulties which were connected with the problem of over-heating of the descending part of the spaceship, during its penetration of the dense layers of the atmosphere, were overcome.

We can, therefore, draw the conclusion that the biological investigations which were conducted up to date by Soviet scientists give a sufficient basis for speeding up a manned space flight.

Very soon a man will undertake a trip into space. In preparation toward this historic achievement, Soviet science and technology play a priceless role, as do also the experiments with animals and primarily with dogs. I. P. Pavlov once said, in a joke, that a dog has made a human being out of a man. Now we can say literally

that a dog has performed one more outstanding service to man: dogs are leading men into space.

Thus, we are approaching the completion of the first stage of cosmic conquest-- the exit of a man into a part of cosmic space which is directly adjacent to the Earth.

Indeed it is remarkable to live in an age when the most daring and remote dreams of man are coming true.

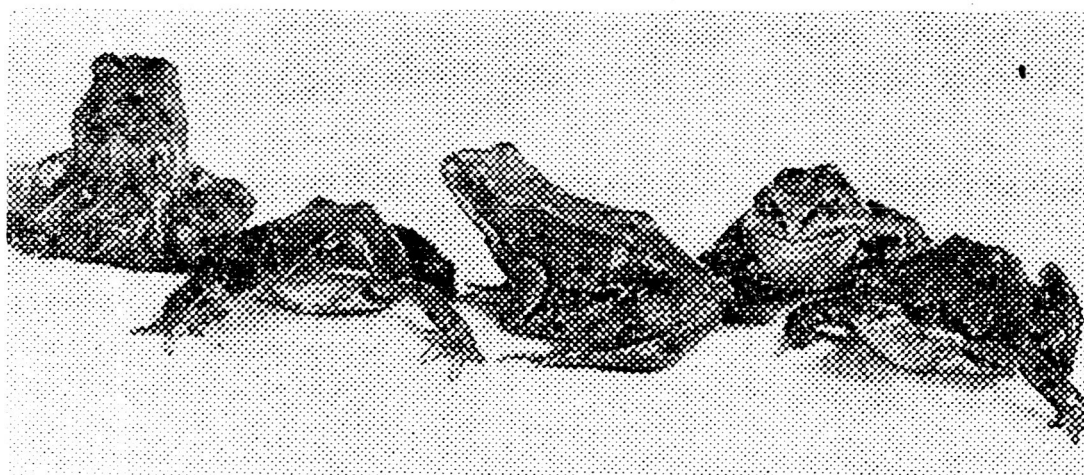
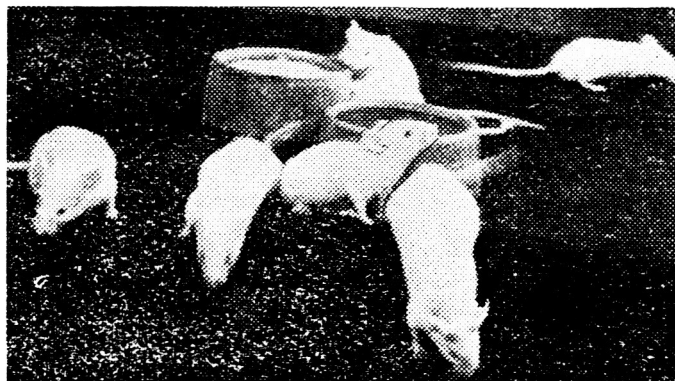
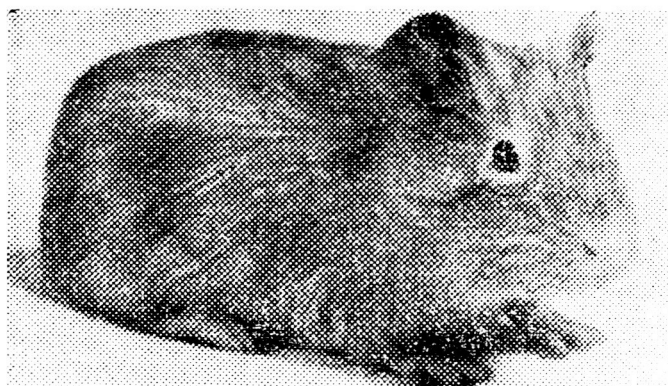


Fig. 1. The first space travelers

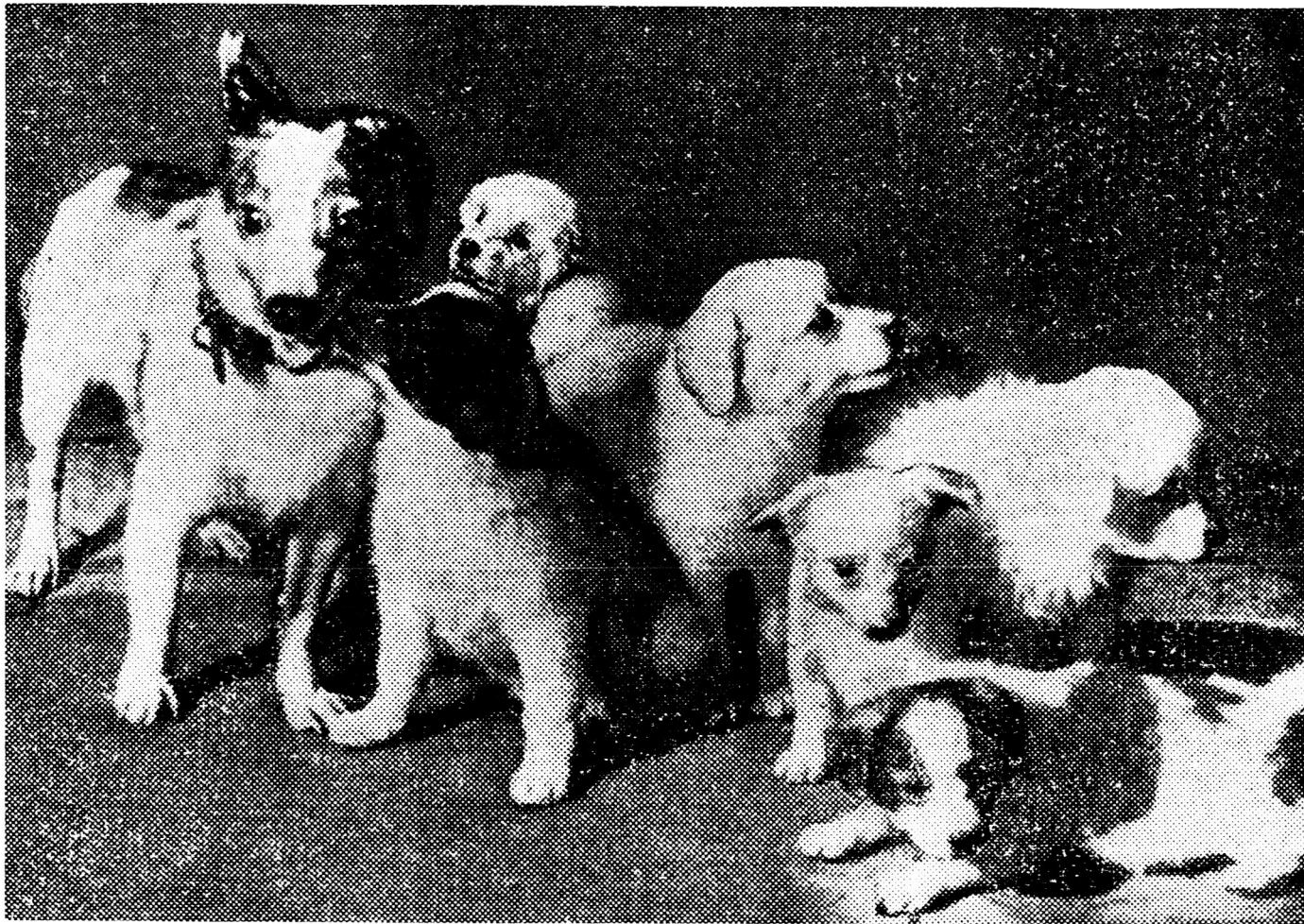


Fig. 2. Strelka and puppies